

Gaseous Helium Reclamation at Rocket Test Systems, Phase II

Completed Technology Project (2011 - 2014)



Project Introduction

GHe reclamation is critical in reducing operating costs at rocket engine test facilities. Increases in cost and shortages of helium will dramatically impact testing of rocket engines for launch vehicles and space propulsion systems as the global supply of this non-renewable element diminishes. Extremely large quantities of helium are being used during rocket engine testing each year at various test facilities. It is critical for program successes to minimize developmental and testing costs by reclaiming helium utilized in those programs and, equally important, to preserve this rare element for future generations. Phase I innovative solution efforts have proven the effectiveness of utilizing hydrogen (H₂) Proton Exchange Membrane Electrochemical Cell (PEMEC) technology to purify an inert gas stream of helium (He) consisting of hydrogen contaminants in a cost-effective manner. This method allows in-situ, on-site helium re-utilization, returning the helium to cleanliness standards required for rocket engine test facility use. Phase I identified the challenges for dilute hydrogen operation of the PEMEC and provided viable solutions for improved efficiency, which allows the PEMEC's to provide high purity, 99.995% helium. Phase I also identified a possible configuration in which the exit stream of H₂ can be added to a fuel cell operating in the galvanic mode to provide power back to the GHe reclamation system. Although Phase II efforts will not utilize that configuration, Phase I verified its feasibility and future system growth potential. Phase II efforts will build upon all the results of Phase I to deliver a fully functional prototype system for further evaluation in an operational environment. Technology Readiness Level (TRL) at the end of Phase I was five (5), while phase II will progress that level to six (6): System/subsystem model or prototype demonstration in a relevant environment.



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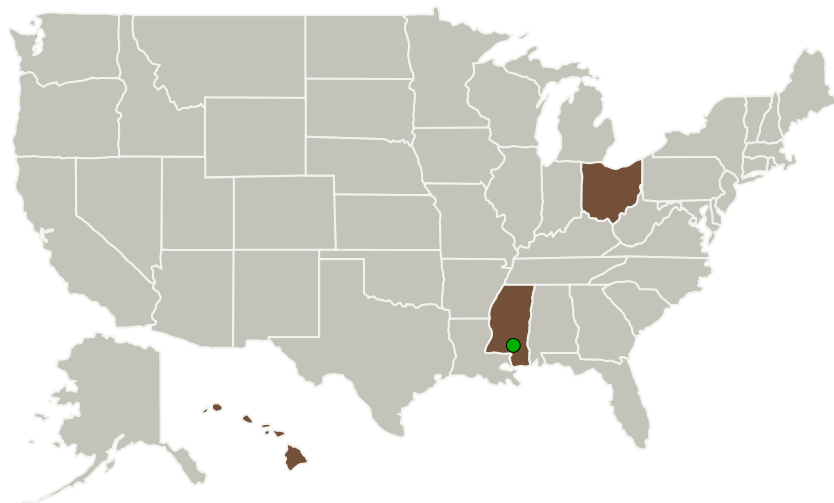
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Sierra Lobo Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	
● Stennis Space Center(SSC)	Supporting Organization	NASA Center	Stennis Space Center, Mississippi
University of Hawaii Maui College	Supporting Organization	Academia	Kahului, Hawaii

Primary U.S. Work Locations

Hawaii	Mississippi
Ohio	

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Sierra Lobo Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Mark S Habermusch

Co-Investigator:

Mark S Habermusch

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Project Transitions



July 2011: Project Start



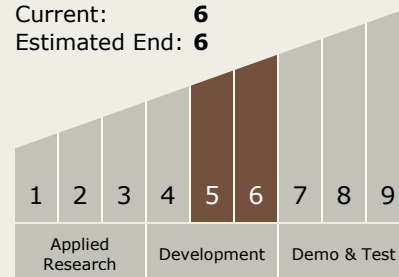
December 2014: Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/137408>)

Technology Maturity (TRL)

Start: **5**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX13 Ground, Test, and Surface Systems
 - TX13.1 Infrastructure Optimization
 - TX13.1.3 Commodity Recovery

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System